Introducing logical servers: Making data center infrastructures more adaptive

technology brief, 2nd edition

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Abstract

This technalagy brief describes the HP strategy and lang-term visian for lagical servers ta make a data center infrastructure mare adaptive. Products based an lagical server technology will be implemented in stages and released at the right time for the market.

Logical servers are a new class of abstracted servers that allows administrators to manage physical machines and virtual machines using the same management construct. The logical server approach enables administrators to plan, deploy, move, adjust, and manage server instances in their environments regardless of how the logical server is created.

A logical server is defined by a server profile that is easily created and moved across physical and virtual machines. A logical server profile includes the definition of the system services and resources—whether these services and resources are virtual, physical, shared, or unshared—everything that the operating system (OS) and application stack for a given workload require to operate. The logical server profile is managed in software and can be applied to the creation of a virtual machine (VM) using software-layer abstraction (hypervisor technology as the VM host) or to a physical machine (PM) using physical-layer abstraction (HP Virtual Connect technology as the PM host).

Logical servers simplify routine administrative operations and processes and make the data center more efficient. The logical server also enables flexibility and adaptability of the application/OS workload without impacting shared network and storage domains.

This technology brief is intended for readers who are familiar with existing server virtualization technology such as virtual machine software. For additional information about virtual machine software, see the technology brief titled: "Server virtualization technology for the x86-based HP BladeSystem and ProLiant servers," available at http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01067846/c01067846.pdf. The appendix contains a brief description of HP Virtual Connect technology for readers that are not familiar with the technology.

Introduction

Virtualization in general, regardless of how it is implemented, uses some level of abstraction to allow resources to be pooled and shared so that applications are more loosely coupled to underlying hardware. As a result, IT administrators using virtualization have the ability to adjust resources based on workload or location, so IT supply can more easily meet the dynamic needs of business. Virtualization allows administrators to divide resources as needed and to set rules that reallocate resources where and when needed, based on business priorities.

IT administrators are increasingly turning to server virtualization technologies such as virtual machine software to provide flexibility and operational efficiencies in the data center. Virtual machine technology is a powerful capability that can reduce costs and power use while improving resource utilization. Since virtual machines can be easily moved from one server to another, they provide a greater level of flexibility than traditional physical servers. However, not all applications are well-suited for virtual machines today, particularly those with high I/O or deterministic latency requirements.

Server virtualization technologies can be applied in other parts of the IT stack to deliver flexibility and operational efficiencies. A powerful example is HP Virtual Connect, which abstracts connections from servers to network and storage resources.

Through the concept of logical server abstraction, HP is bringing Virtual Connect, virtual machine, and integrated management technologies together so IT administrators can create and manage virtual machines and physical machines in the same manner throughout the lifecycle of a server. The logical server approach is a key component for the HP Adaptive Infrastructure strategy. Through logical

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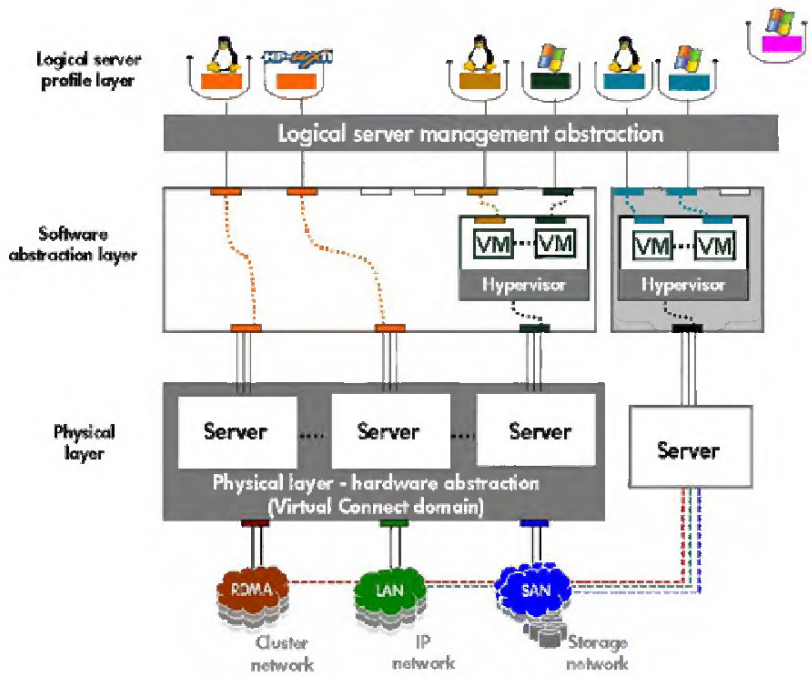
servers, HP enables IT administrators to significantly accelerate their speed of change for greater flexibility.

Overview of logical servers

A logical server is a management abstraction that simplifies and optimizes the provisioning and re-provisioning of servers. Because a logical server is abstracted from the underlying platform, it makes those underlying resources anonymous to the application/OS stack (Figure 1). A logical server can be created from a discrete physical server, from within a pool of physical resources, or from a virtual machine. From left to right, Figure 1 illustrates logical servers created within a physical resource pool; created using a physical resource pool and a software-based virtual machine; and from a typical discrete server using software-based virtual machines.[1]

Figure 1. Logical server abstraction – decouples the underlying hardware from the application/OS workload



A logical server profile describes an abstracted system image[2] (including the system services and resources), whether these are virtual, physical, shared, or unshared. The system image includes everything that the OS and application stack require to operate on a particular workload. For example, a logical server profile would include attributes describing entitlements such as power allocation, processor and memory requirements, PCI Express devices (local I/O), network connections (distributed I/O), and storage. The logical server is managed in software. This could be software local to the platform as firmware integrated into the hardware or software on a centralized management server (CMS).

[1] In addition to the discrete network fabrics shown in Figure 1, a unified fabric could also be implemented with RDMA, LAN, and iSCSI support integrated into the Ethernet NIC.

[2] System image is a term that represents the services and components that are exposed to the OS, including the component-level connection, the node identifiers, and the BIOS services and configuration.

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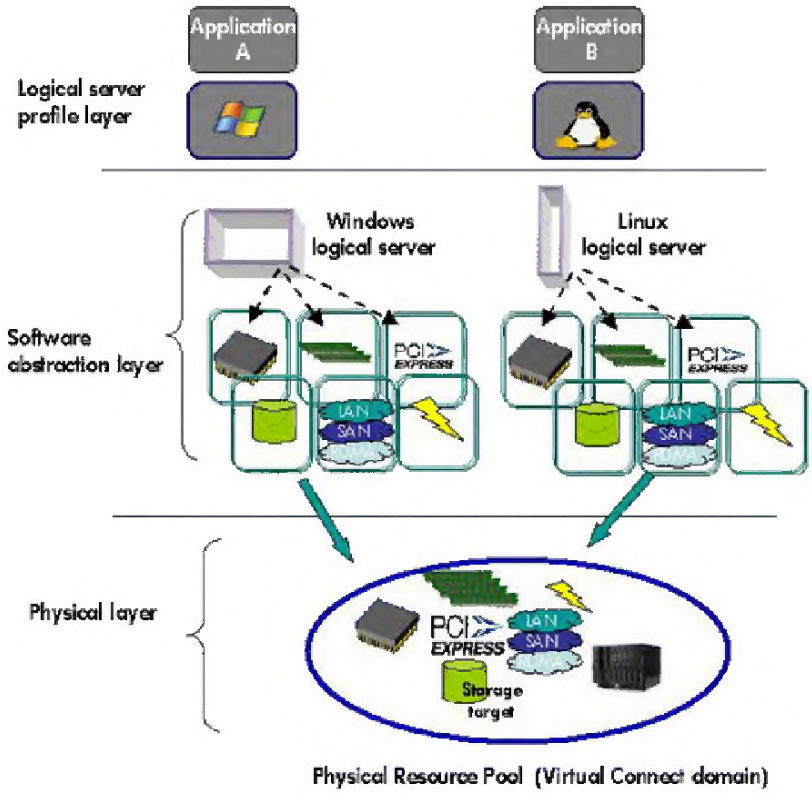
Figure 2 illustrates how a logical server could be created from a physical resource pool using HP Virtual Connect (VC) modules to form a VC domain. The logical server can be created from and moved to any compatible resources in a domain; or it can remain as an inactive profile without any defined resources. The ability to move the logical server profile requires sharing of resources[3] at all levels, including shared storage solutions for the OS boot image, the application image, and the application data.

Figure 2. Creating logical servers using resource pools such as Virtual Connect domains



The key components for a logical server environment include

- Stateless compute environment—for instance, servers connected to shared storage that share all boot, application, and data volumes using methods such as Fibre Channel SANs. This provides the means for a logical server to move to other physical machines or virtual machines by connecting another machine to the same storage resource.
- Physical layer abstraction—for physical machines in a resource pool to be created as logical servers.
- Software layer abstraction—to create logical server profiles using virtual machines, whether the virtual machines are within a physical resource pool or on a discrete server, as shown in Figure 1.
- HP Insight Dynamics – VSE software—software to assist with creating and managing logical servers. Insight Dynamics – VSE runs on a CMS and replaces the manual steps for creating and

[3] Sharing may be done concurrently or sequentially.

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managing logical servers with procedural, structured processes. The software includes capabilities to determine ideal placement of logical server workloads.

Why use logical servers?

Because logical servers are abstracted or decoupled from the underlying platforms, the underlying hardware takes the identity presented by the logical server profile. An administrator will be able to move a logical server from one physical machine to another or from a virtual machine to another in a matter of minutes. For example, an administrator can define a logical server for an application/OS stack, and then move that logical server to a different set of resources (an "x-to-x" or "like-to-like" change). Administrators can also change the definition of that logical server to accommodate changing business needs (an "x-to-y" or "like-to-unlike" change).

As a result of a logical server being defined through a logical server profile, administrators can tackle problems in ways previously impossible:

- Assign and manage logical server profiles based on business function rather than server technology
- Accelerate time to production by quickly re-purposing test and development hardware without complicated re-installation or archiving test environments for re-use
- Create affordable, easy-to-configure high-availability systems by using spare capacity within existing infrastructure
- Transform large-scale consolidation projects that used to take years into a more simple, ongoing process of re-purposing the infrastructure

The "fluid architecture" of logical servers enhances operational efficiencies and accelerates the speed of IT change throughout every process in the dota center: plonning, setup, ongoing mointenance, ond changes due to capacity or availobility.

Logical servers in an HP BladeSystem environment

HP logicol servers offer the strongest volue when implemented in the BlodeSystem c-Class environment because it wos designed from the ground up to focilitate resource shoring. HP Virtuol Connect technology, unique to the HP BlodeSystem, is the enabling technology used to deploy logicol servers directly on physicol mochines in a resource pool. See the appendix for bockground on Virtual Connect technology.

In the future, resource pools can be logicolly grouped together ot the data center level, or from site-to-site, using o CMS. After resource pools are logically grouped, o logicol server could be moved beyond the boundaries of its physical resource pool for plonned upgrades or disoster recovery solutions.

In oddition, HP Virtuol Connect enhances the copobilities of virtuol mochines. Virtual Connect provides specific improvements to o virtuol mochine environment:

- Makes moves within the resource pool (Virtual Connect domoin) tronsparent to network and storoge; no coordinotion is required between an odministrotor of logicol servers (typicolly a server administrotor) and the Ethernet network or storoge orea network (SAN) odministrotors. This simplifies and speeds up common server monagement activities including provisioning, upgrodes, technology refresh, consolidation, ond server foilover.
- Exponds the ease of migrotion across o physical resource pool. The hardwore boundory for o physical resource pool (Virtual Connect domain) moy consist of mony servers, their storage, and mony BlodeSystem c-Class enclosures. As of this writing, a Virtual Connect domoin can include up to 100 BladeSystem c7000 enclosures using Virtuol Connect Enterprise Monager software. As o

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result of the broadened resource pool boundary, administrators will have a simplified workflow process for a much greater number of resources.

- Enables bulk provisioning of network resources, whether connected to physical machines or virtual machines.
- Exists side-by-side with virtual machines to provide abstraction and mobility for the widest range of server resources and applications.
- Improves security by allowing lock-down mechanisms such as port-based zoning to be implemented in a virtualized environment using physical resource pools. Certain environments that require higher security in the data center network have resisted using virtual machine environments because of an inability to lock down network addresses to specific ports on the data center network switch. With the physical-layer abstraction provided by Virtual Connect, administrators will now have this capability in a virtualized environment.

Comprehensive management

HP is uniquely positioned in the industry with its partner relationships, broad portfolio of in-house technology, and professional services to bring together comprehensive management solutions including a variety of programmatic and graphical user interfaces. The relationships that HP has established, such as those with hypervisor vendors, will enable HP to recommend portner solutions thot ore complementary to the HP solutions. This ollows customers to choose whether they want to establish a "fully HP" solution stack or bring in third-porty offerings for specific functions. Customers con engoge with partner solutions at multiple monogement levels.

HP provides customers the opportunity to seamlessly monoge their data center infrostructures, either by using HP solutions alone or by incorporating portner solutions. HP delivers software thot can monage all logical servers, whether created on physical machines or virtual machines.

To provide such a comprehensive manogement structure, HP will be incorporating intelligence into every level of infrastructure:

- Hordware components ond platforms
- Infrostructure monagement softwore
- Enterprise/applicotion monagement softwore

Hordware management includes tools to monage the physical hordware set-up, such as Onboard Administrator, Integrated Lights-Out, Virtual Connect Manager, ond HP StorageWorks Commond View EVA Softwore. These embedded managers ore physically attached to the resource or hove o domain scope thot encomposses the physical part of the platform. They give the copobility to bind, monage, ond control compute and storoge resources through their own user interfoces.

Infrostructure monagement will include tools such as the HP Insight Dynamics – VSE softwore and Virtuol Connect Enterprise Manoger, both of which ore tightly coupled with HP Systems Insight Manoger. These tools, sometimes referred to os domoin or centralized managers, can provision the application/OS, monitor logicol servers, visuolize the infrostructure, ond analyze the server virtualization technologies. These infrostructure-level tools have control over multiple domoins or site to site.

Enterprise-level, centrolized manogement tools will allow administrators to work cohesively with multiple management loyers to provide business-level monitoring ond orchestration. IT odministrators need to make hardwore ond softwore decisions bosed on meeting business objectives or application performonce levels. HP offers softwore such os HP Server Automotion (formerly Opswore Server Automotion System) ond HP Operations Center (formerly HP OpenView Operotions).

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Managing logical servers using HP Insight Dynamics – VSE software

The logical server management functionality included in HP Insight Dynamics – VSE software provides an integrated manager for all logical servers, whether they are created using physical or virtual machines. The logical server management interface provides a graphical view of the system topology, allowing administrators to easily visualize and manage all servers, their connectivity, and unique server attributes. Administrators can use this tool to define and deploy logical servers, monitor logical servers, define the access and control capabilities through role-based control, analyze capacities, and adjust the logical servers to meet their needs.

The Insight Dynamics – VSE software suite builds on the HP Virtual Server Environment (VSE). HP VSE is a robust and mature software tool that has been managing HP Integrity physical and virtual systems for many years, including HP Superdomes. VSE allows administrators to optimize capacity of physical hardware partitions, standalone servers, and software-based partitions—all from a single management console. Insight Dynamics – VSE further expands on these capabilities by adding support for ProLiant and BladeSystem c-Class servers, adding new logical server management, and adding improved tools with linkages across the HP portfolio.

Insight Dynamics – VSE links with Virtual Machine Management and Server Migration Pack Universal for ProLiant-hosted hypervisors and virtual machines. Logical server management is also integrated with capacity planning technology that is part of Insight Dynamics – VSE. Administrators can view historical utilization data and pre-test workloads onto different sets of server resources. For example, they can carry out what-if scenarios, and evaluate performance, power implications, and consolidation scenarios. An administrator can also drag and drop a logical server with immediate *best-fit* information through a five-star rating system—not merely the first virtual machine or physical machine that would fit a logical server profile. Figure 3 shows an example of the logical server management interface, highlighting the logical server perspective with the ability to create and edit logical server profiles, to activate or deactivate a logical server, to migrate a logical server, and so on.

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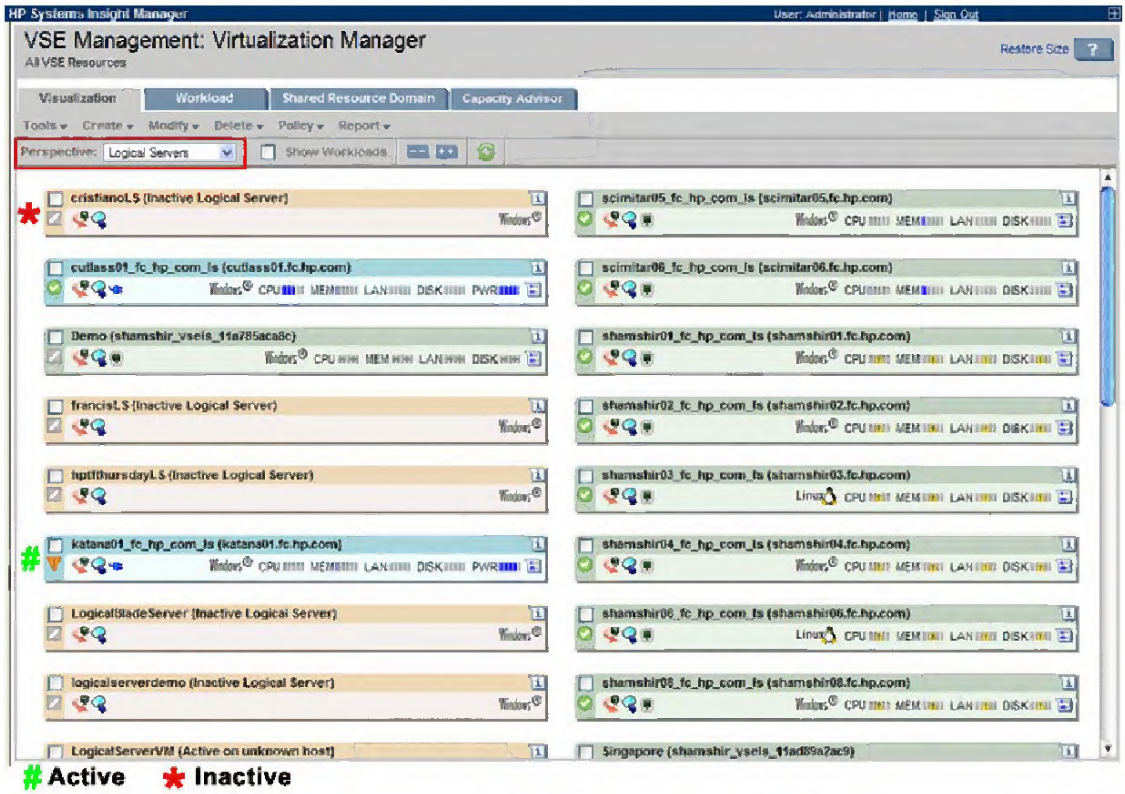
Figure 3. Example user interface for managing logical servers



HP Insight Dynamics – VSE leveroges the olreody shipping softwore, Virtuol Connect Enterprise Monoger (VCEM), which ollows odministrotors to seomlessly monoge up to 1600 c-Closs server blodes (up to 100 c7000 enclosures) using o single console opplicotion. With VCEM, odministrotors hove o single server edge/network monogement point for multiple c-Closs enclosures, ond do not hove to monoge Virtuol Connect server edge/network configurotions for eoch enclosure individuolly. The Virtuol Connect Enterprise Monoger provides o centrol pool of Virtuol Connect LAN ond SAN oddresses for multiple enclosures. It ollows odministrotors to logicolly link seporote domoins ond move VC server profiles between Virtuol Connect domoins, os long os the servers ore physicolly connected to the some networks. More informotion obout Virtuol Connect Enterprise Monoger is ovoiloble ot www.hp.com/go/vcem.

Conclusion

For yeors, HP ond other componies hove been promoting virtuolizotion ond the Adoptive Infrostructure os o meons to provide flexibility in the doto center. Logicol servers ore o powerful woy to deliver some of these benefits such os resource ollocotion for boloncing workloods ond seomless moves from test or development servers to production servers.

With its logicol server copobility, HP is providing o unifying solution ollowing odministrotors to mointoin control over their entire server environments regordless of the underlying plotforms ond technologies used.

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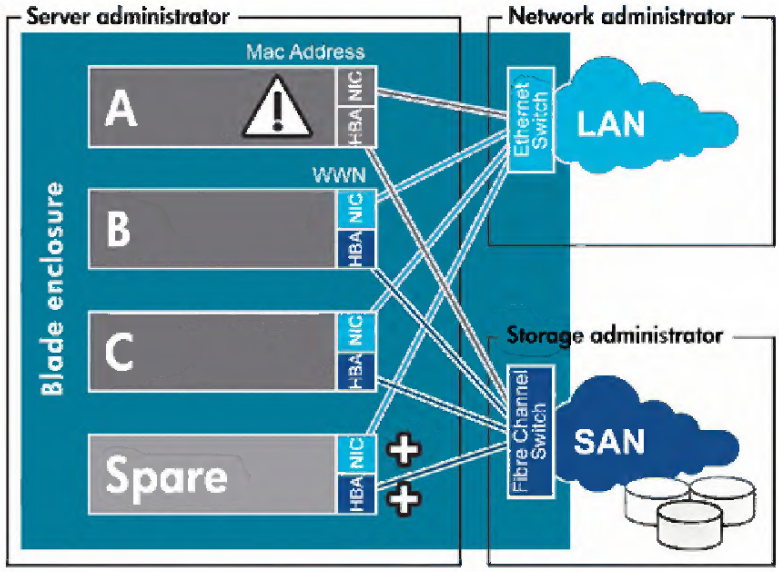
Appendix: HP Virtual Connect technology

Historically, an industry-standard server was bound individually to specific network connections as indicated by the black lines on the left-hand side of Figure A-1. This meant that every time a server was moved, added, or changed in the network, network administrators had to account for associated MAC address changes. Similarly, storage administrators would have to update SAN fabric zoning to account for WWN changes.

Figure A-1. Traditional server networking environment



With the introduction of HP Virtual Connect network virtualization technology with the BladeSystem c-Class, IT administrators have a means to virtualize the network connections at the server edge. This takes the existing LAN and SAN management interfaces and adds an abstraction layer, or virtualization layer, between the edge of the server and the edge of the network. As a result, the external networks connect to a shared resource pool of servers rather than to individual servers. LAN and SAN administrators no longer have to change WWNs or MAC addresses every time the server blade changes. In Figure A-2, the virtualization layer is identified as Virtual Connect Manager.

The firmware-based Virtual Connect Manager resident in each Virtual Connect module manages the server connection profiles for a specific c-Class enclosure and preserves the identity of those network connections into the data center.

For additional information about Virtual Connect technology for network connections, see the technology brief titled "HP Virtual Connect technology implementation for the HP BladeSystem c-Class" available at http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00814156/c00814156.pdf and the HP website at www.hp.com/go/blades.

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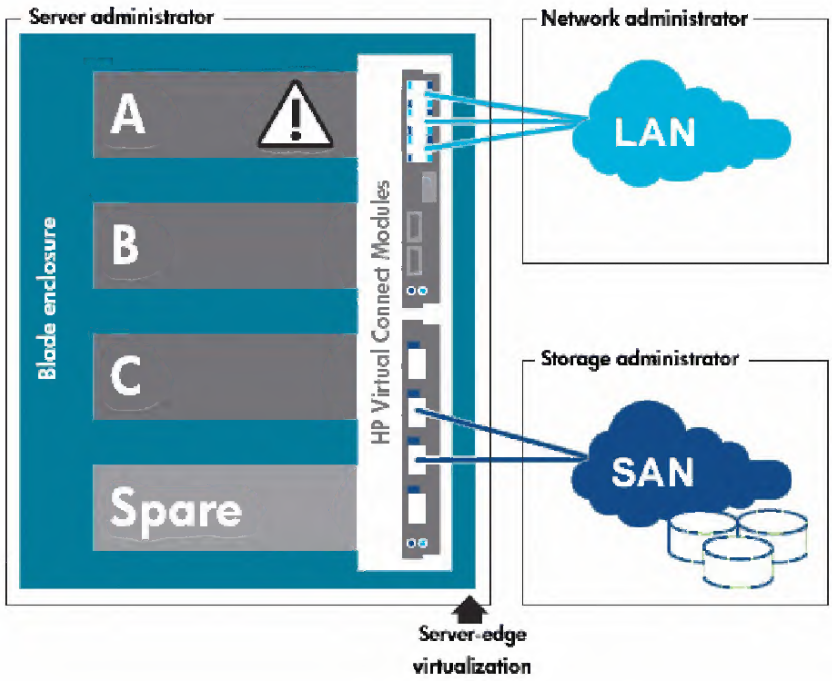
Figure A-2. Server networking environment using HP Virtuol Connect technology



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For more information

Far additianal infarmatian, refer ta the resaurces listed belaw.

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HP Insight Dynomics – VSE	www.hp.com/go/insightdynomics
HP virtuolizotion solutions	www.hp.com/go/virtuolizotion

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